



# **Armed Forces College of Medicine AFCM**



# Development of GIT 2

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# INTENDED LEARNING OBJECTIVES (ILO)



**By the end of this lecture the student will be able to:**

- 1. List the sources of various components & steps of development of liver, biliary system & pancreas.**
- 2. Explain the congenital anomalies of liver, biliary system & pancreas.**
- 3. Describe the steps of development of hindgut, including its components, peritoneal coverings & anomalies.**
- 4. Identify the parts, subdivisions, fate & anomalies of the cloaca.**

# Lecture Plan

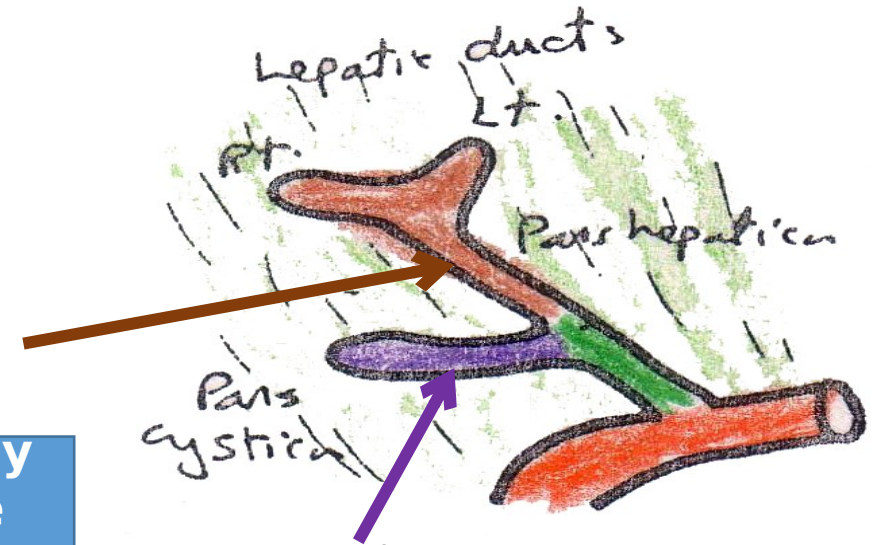
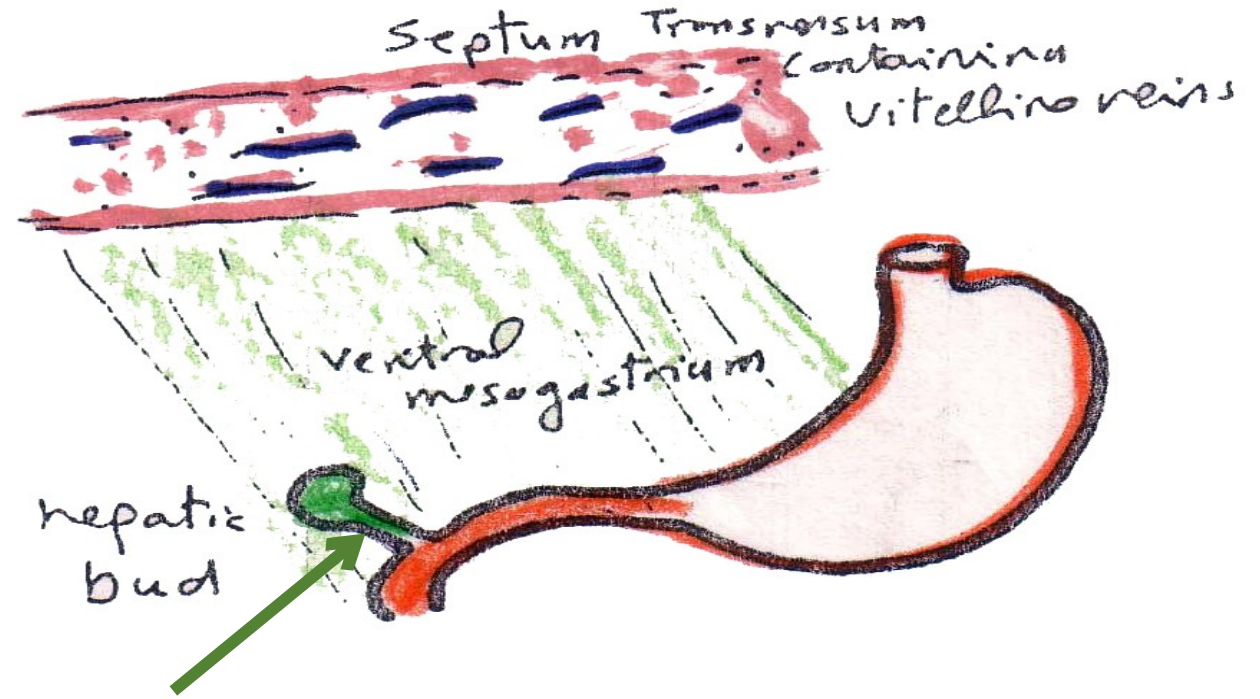


1. Part 1 (10 min) Introduction to vertebra-basilar arterial system
2. Part 2 (20 min) Blood supply of spinal cord
3. Part 3 (20 min) Lesions of spinal cord
4. Summary (5 min)

# Liver

- A **hepatic bud** arises from the **duodenal loop** at the most distal part of the foregut.
- The **bud** elongates into the ventral mesogastrium & divides into:

**1- Pars hepatica**  
(cranially).



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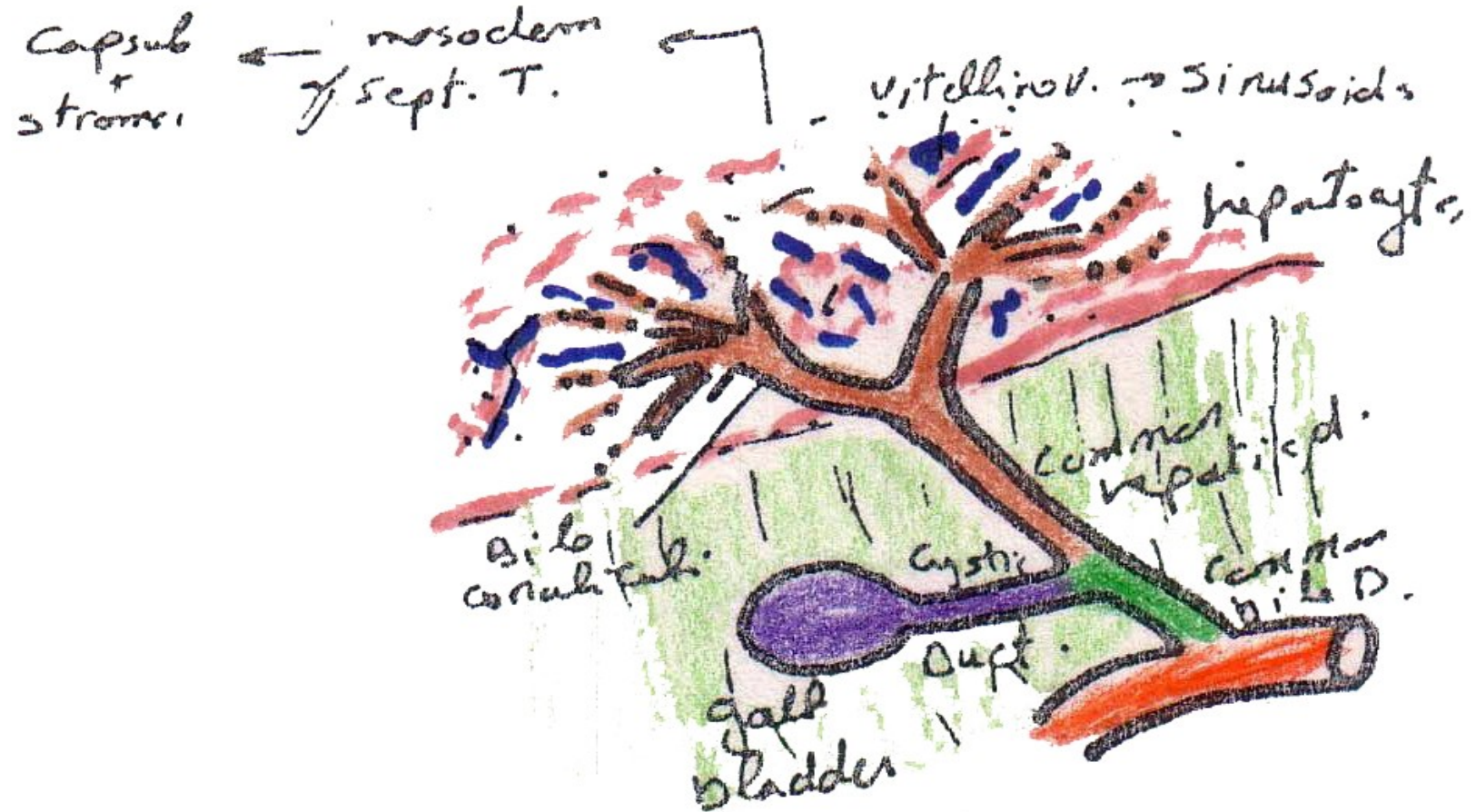
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# Pars cystica



- Its **distal** part dilates → Gall bladder.
- Its **proximal** part remains narrow → Cystic duct.



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# Pars hepatica

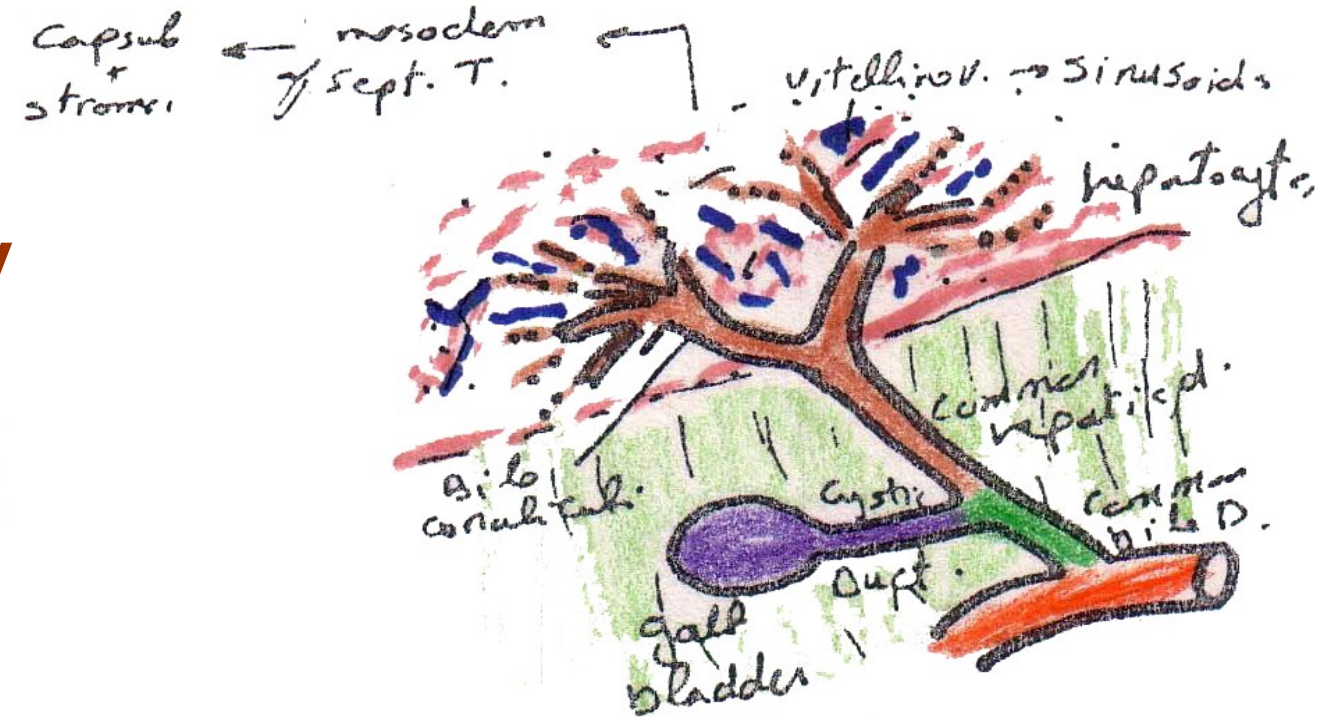


- It divides into **Rt. & Lt. hepatic ducts** which invade the overlying septum transversum (= future diaphragm):

1- The **ducts break repeatedly** inside the septum mesoderm into a great number of branches:

- a. Terminal brs. → **Hepatocytes.**
- b. Proximal brs. → **Intrahepatic biliary system.**

2- The **vitelline Vs.** (inside the septum) are broken by the growing biliary tree → **Liver**

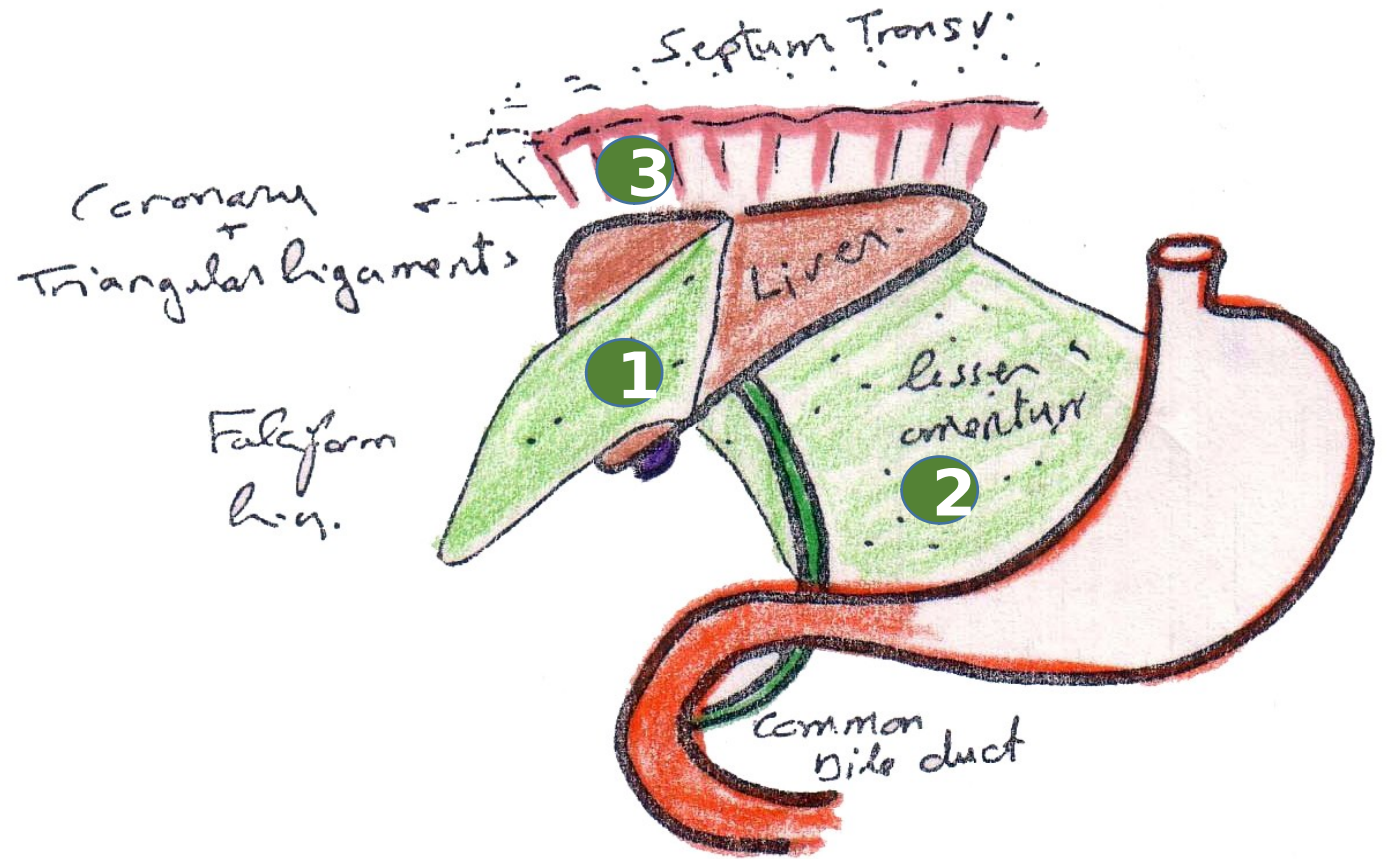


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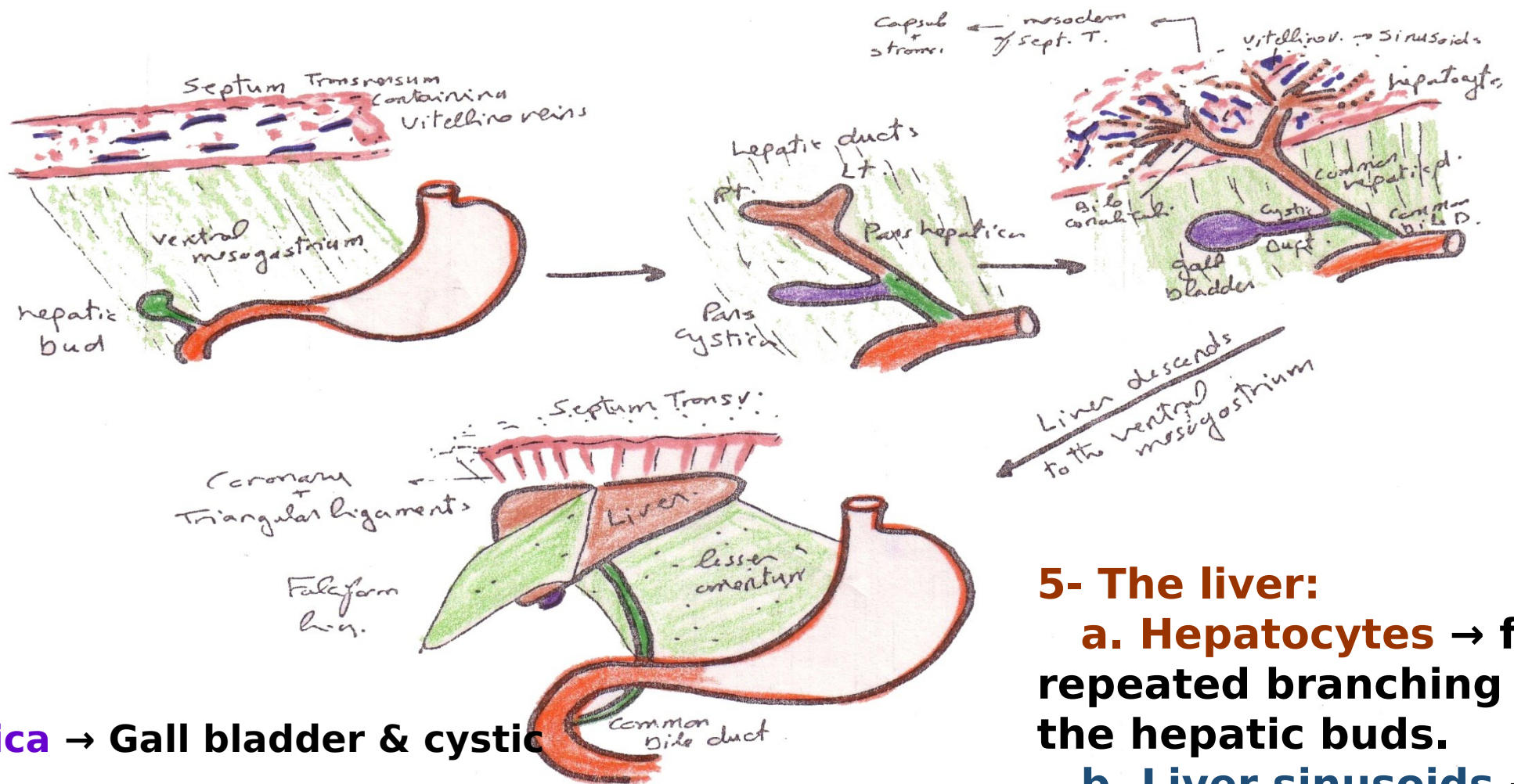


- The **liver** finally grows bet. The 2 layers of the **ventral mesogastrium** dividing it into:

- 1- **Ant. part** (bet. Liver & AAW) → Falciform lig.
- 2- **Post part** (bet. Liver & stomach) → Lesser omentum.
- 3- **Sup. part** (bet. Liver &



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## 5- The liver:

a. **Hepatocytes** → from repeated branching of the hepatic buds.

b. **Liver sinusoids** → from breaking of the vitelline Vs.

c. **Liver stroma** → from mesoderm of septum transversum.

6- Derivatives of the

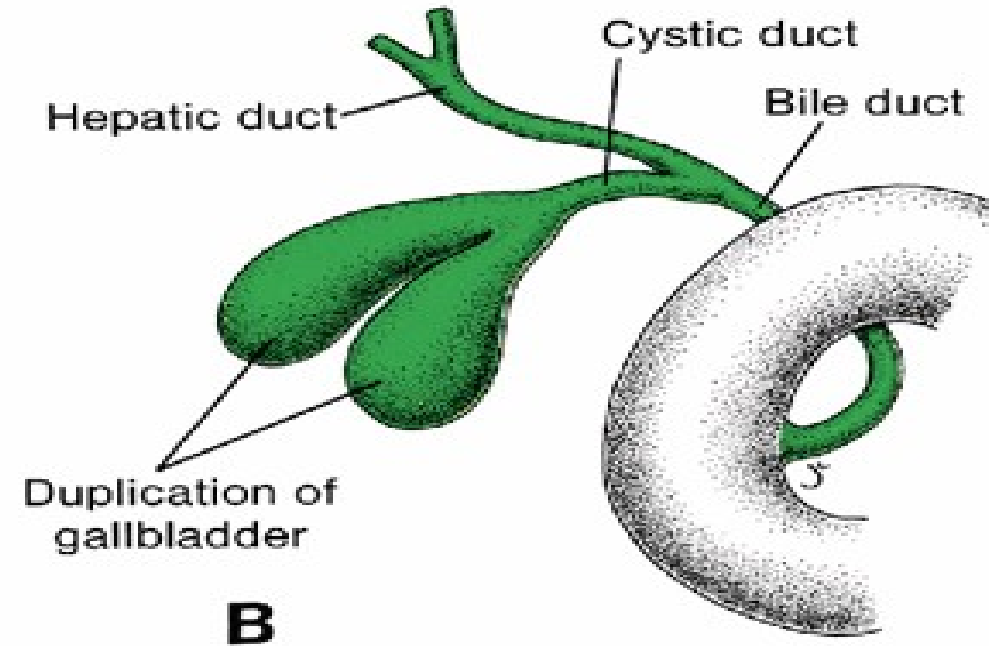
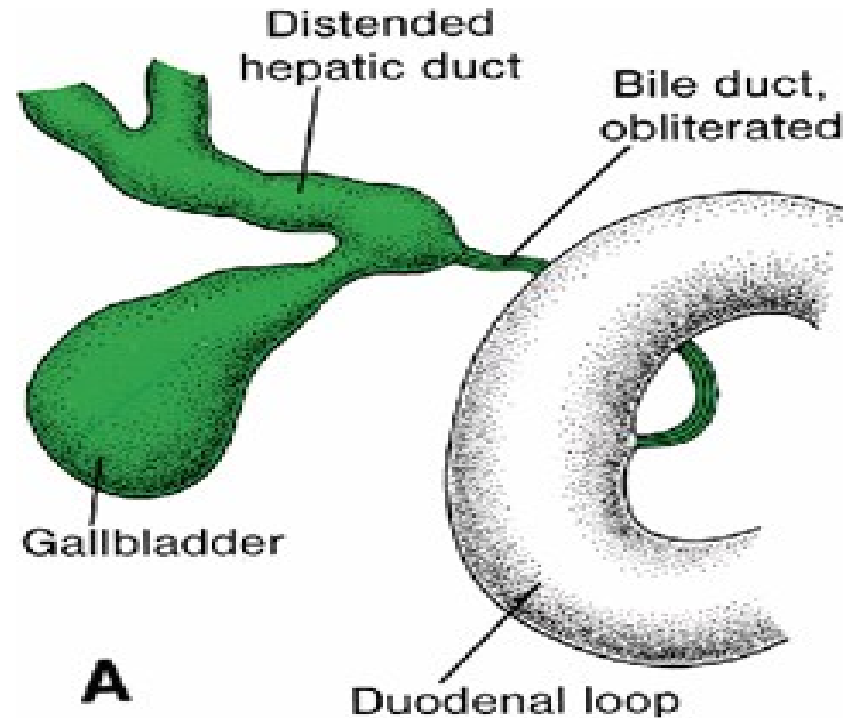
1- **Pars cystica** → Gall bladder & cystic duct.

2- **Proximal part of hepatic bud** → Common bile duct.

3- **The stem of pars hepatica** → Common hepatic duct.

4- **The 2 brs. of pars hepatica** → Rt. & Lt. hepatic ducts.

# Anomalies



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**A. Atresia of bile ducts → Jaundice.**

**B. Bifid of double intrahepatic ducts or gall bladder.**

**C. Agenesis of a part of liver, gall bladder, or ducts.**



### **Capsule, serosa & stroma of liver are derived from:**

- a. Pars hepatica.
- b. Pars cystica.
- c. Hepatic bud.
- d. Mesoderm of septum transversum.
- e. Middle of the duodenal loop.



**Capsule, serosa & stroma of liver are derived from:**

- a. Pars hepatica.
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- e. Middle of the duodenal loop.

# **My reaction when someone says that Medical is easy**



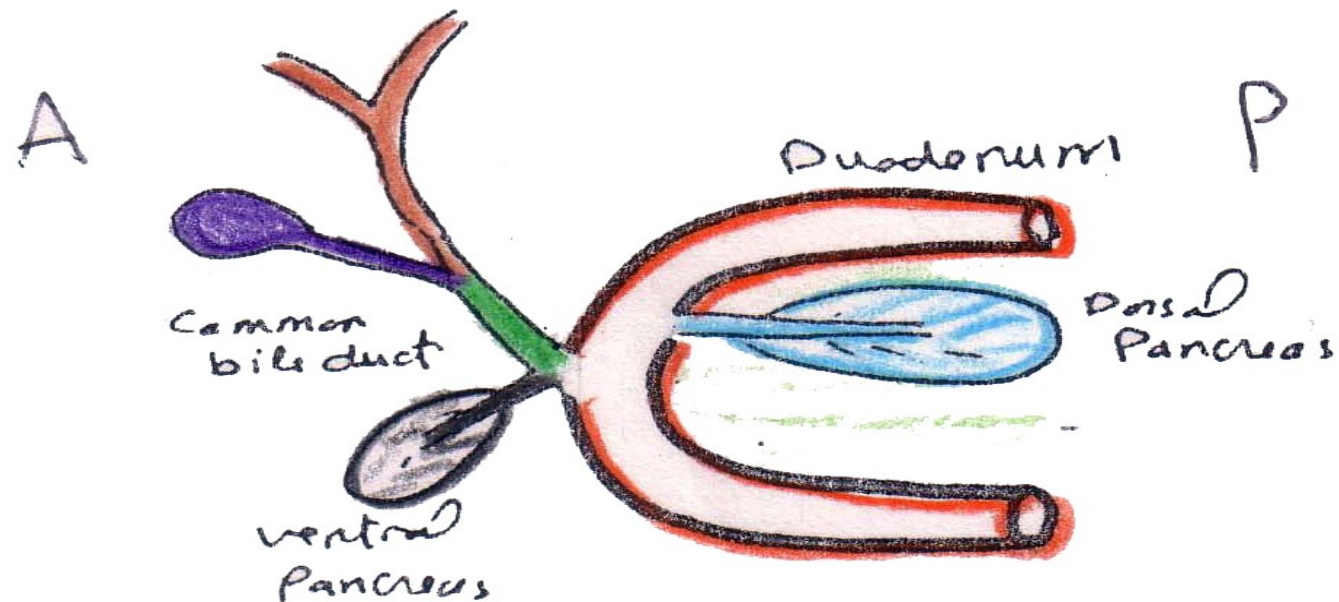
# Pancreas

- Develops from 2 sources:

**1- Ventral pancreas** (a bud from the proximal part of hepatic bud = future common bile duct).

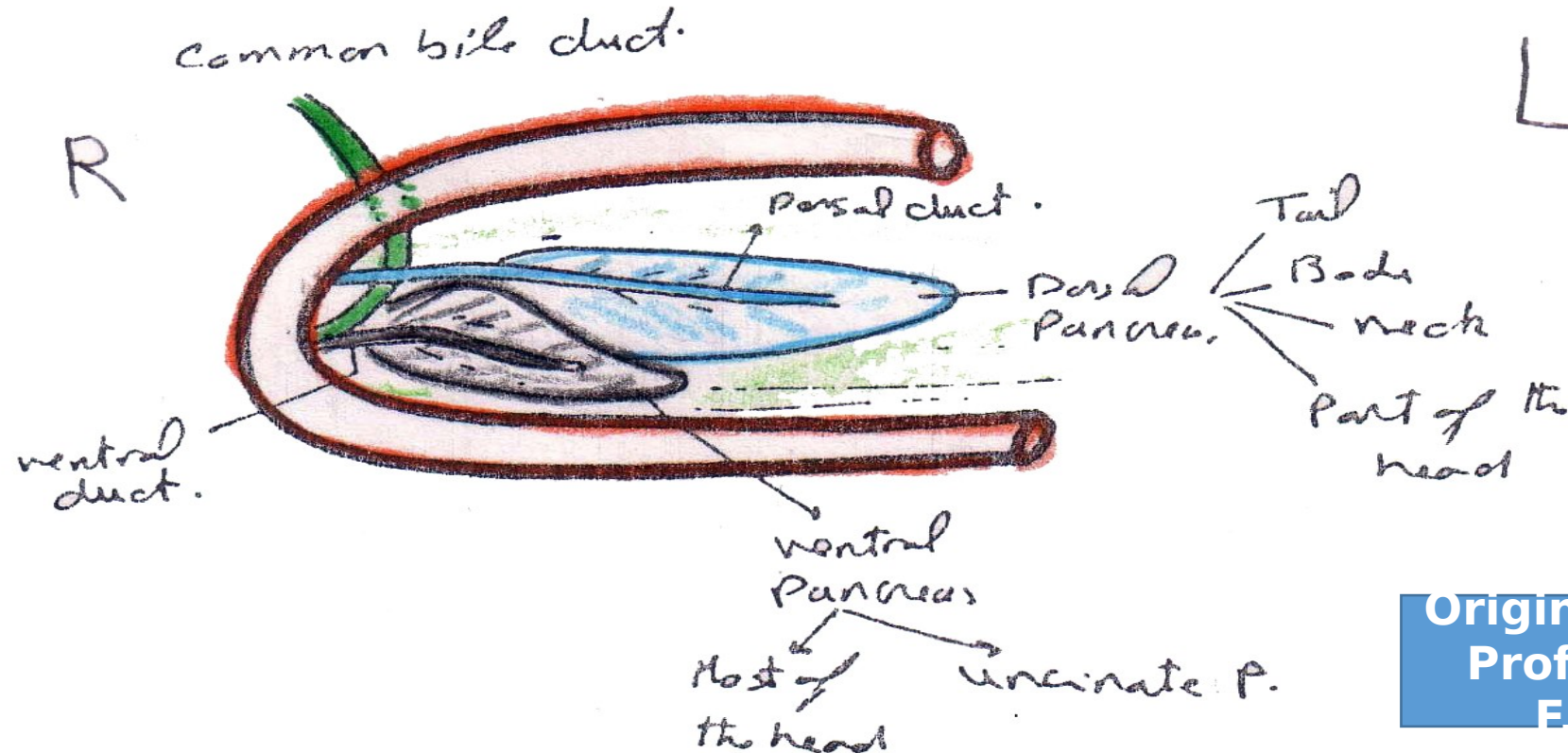
**2- Dorsal pancreas** (a bud from the concavity of the duodenal loop just proximal to the level of common bile duct).

\* Repeated branching of both buds → **ducts & acini of the pancreas.**



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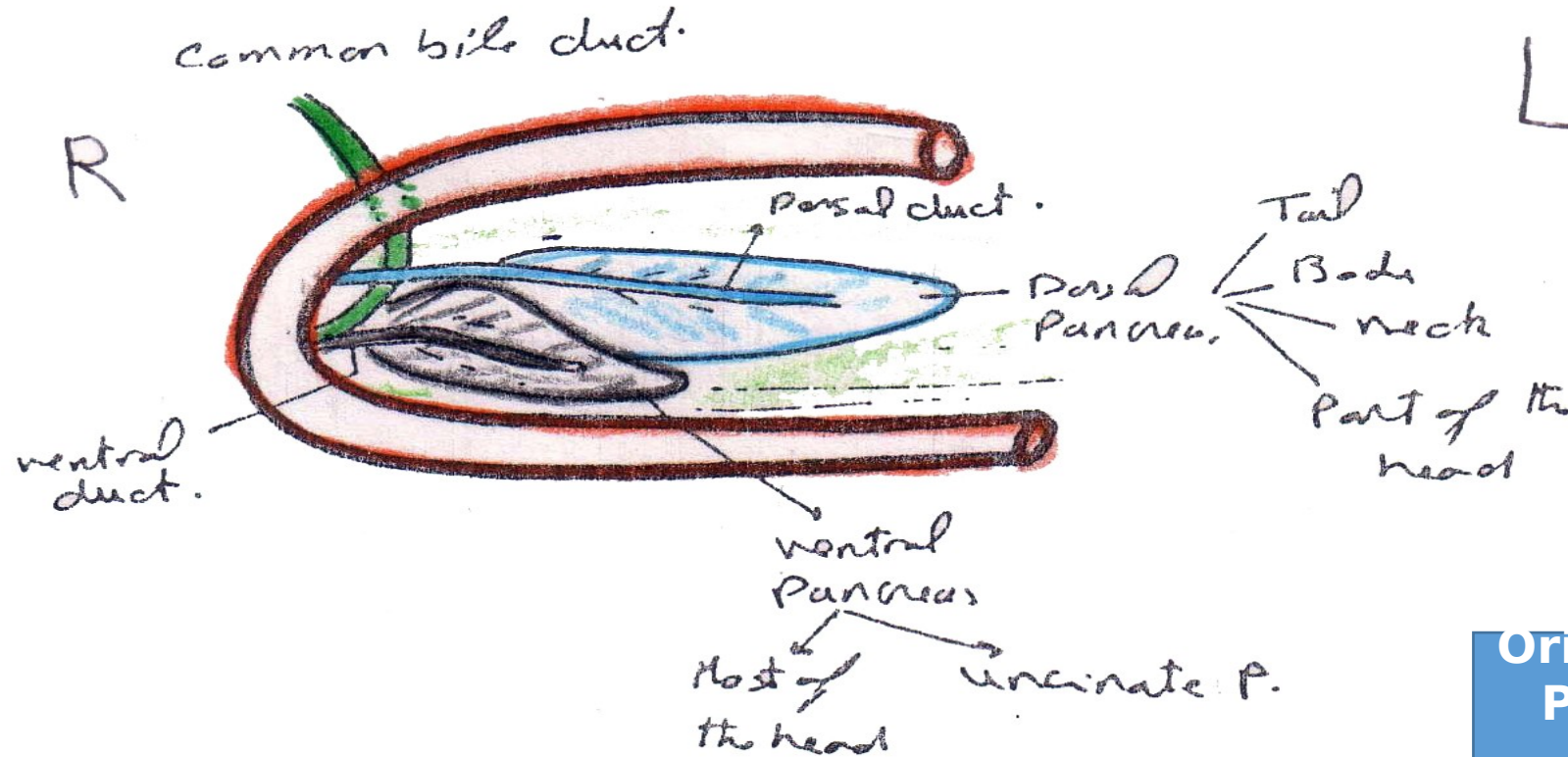
# What happens ?



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- The **ventral pancreas** rotates around the Rt. side of the duodenal loop & fuses with the **dorsal pancreas** inside the mesoduodenum.
- After the absorption of the mesoduodenum, the pancreas becomes retro-peritoneal.

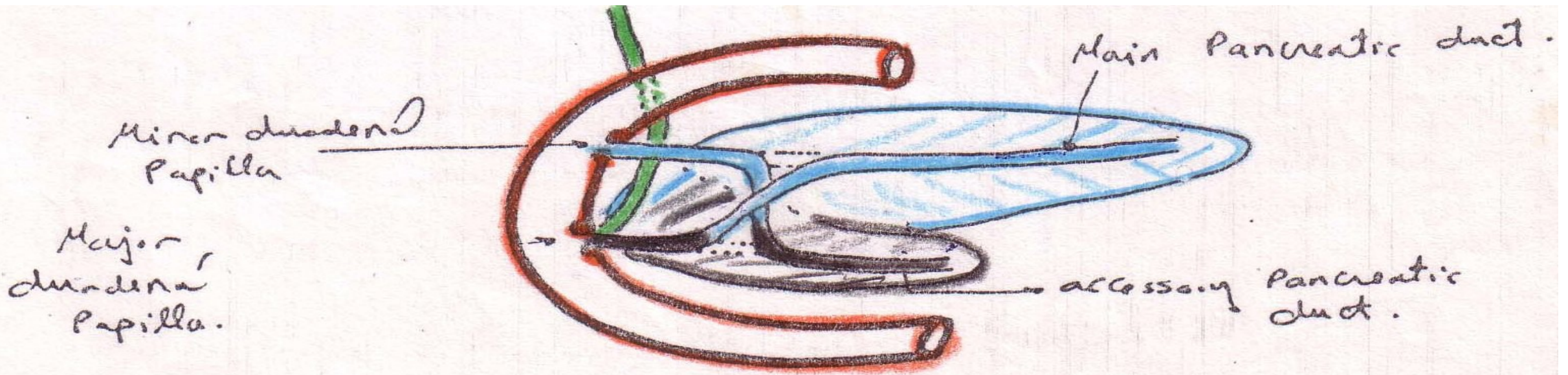
# Derivatives of each pancreas



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- The **ventral pancreas** → uncinate process & majority of head of pancreas.
- The **dorsal pancreas** → remaining small part of the head, neck, body & tail of pancreas.





• Connections occur bet. the ducts of ventral & dorsal pancre

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1- The main pancreatic duct is formed by:

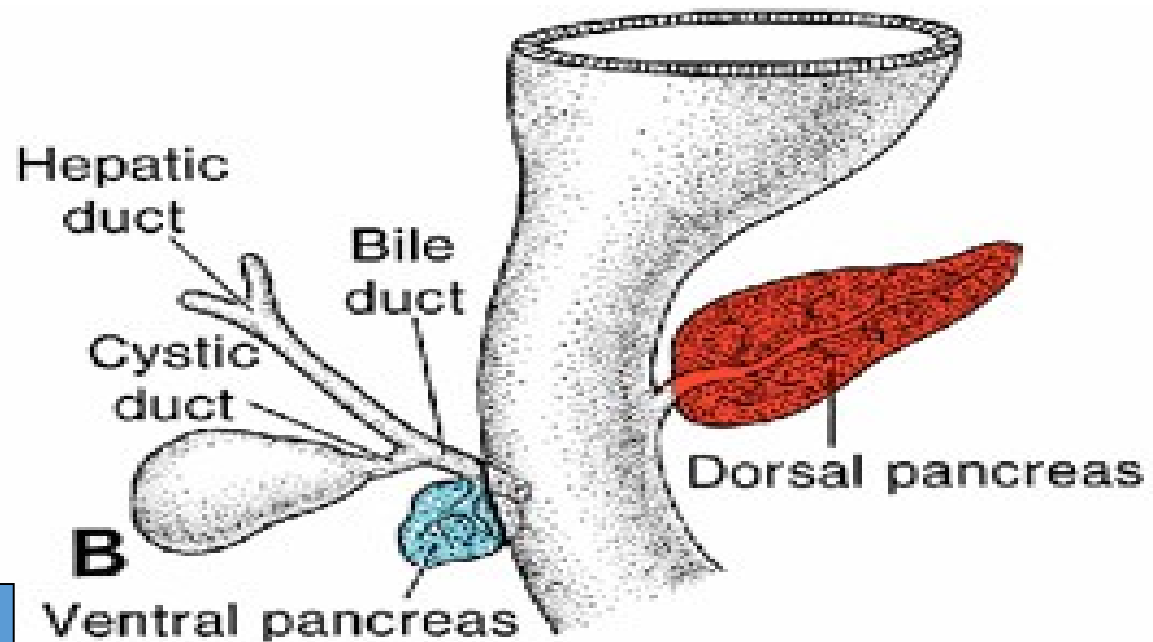
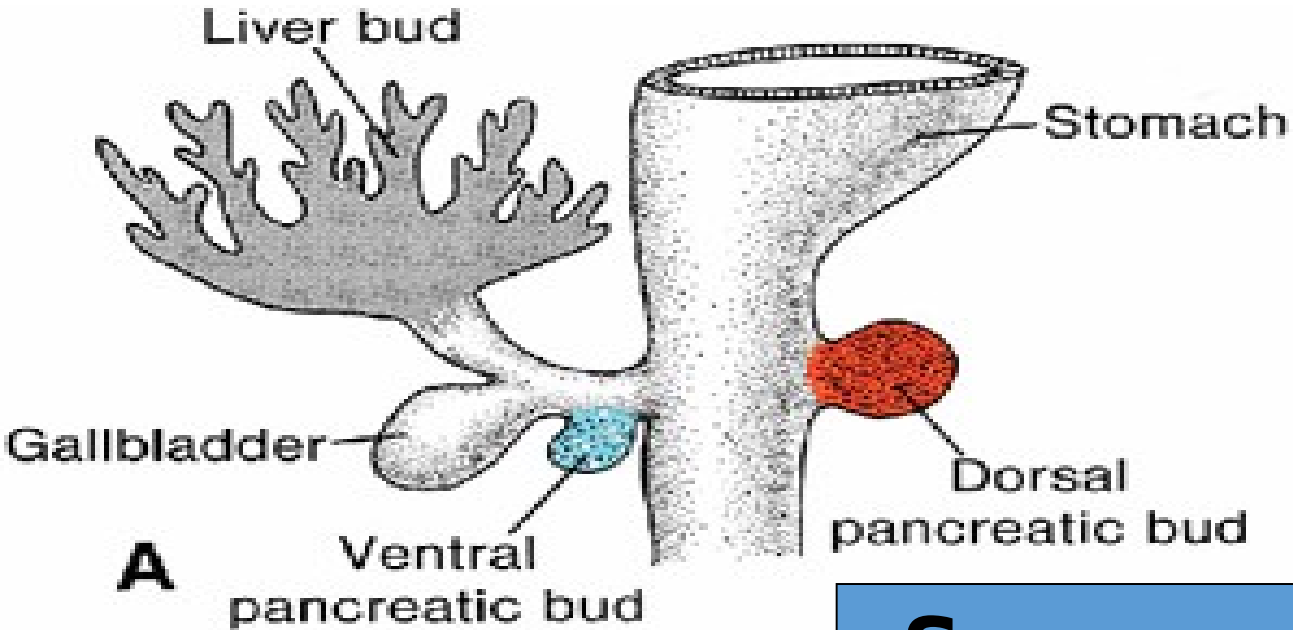
- a. Distally by the **dorsal pancreatic duct**.
- b. Proximally by the **ventral pancreatic duct**.

(This explains the common opening of both pancreatic duct & **CBD** in the duodenum).

2- The accessory pancreatic duct is formed by:

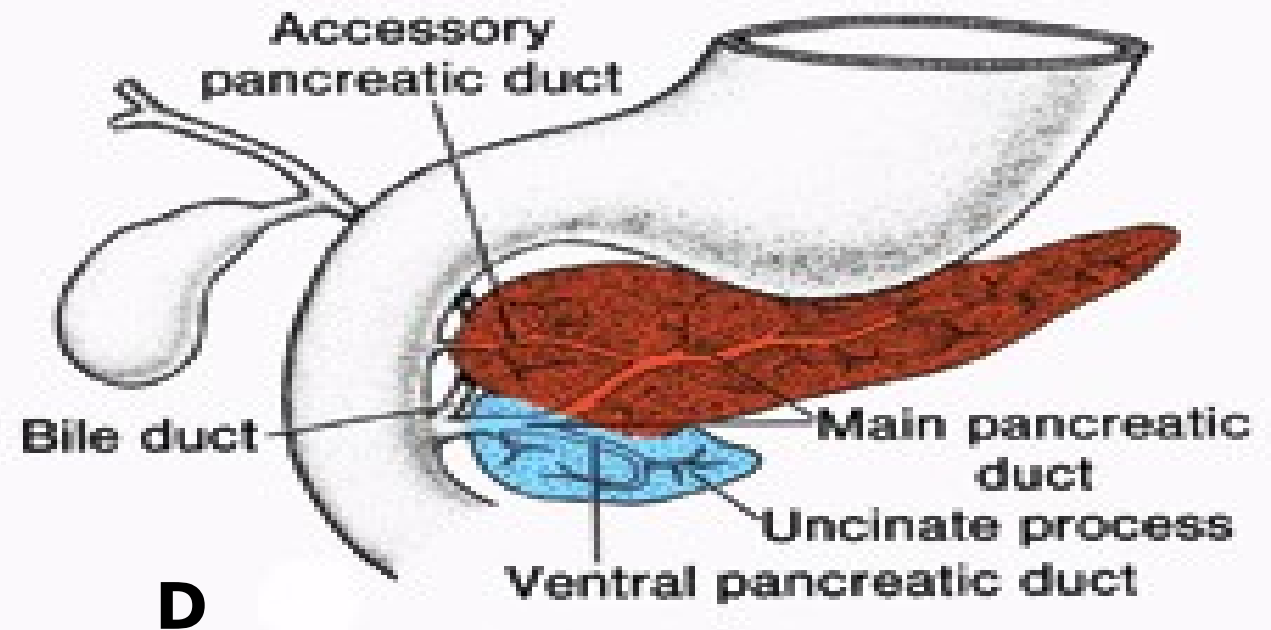
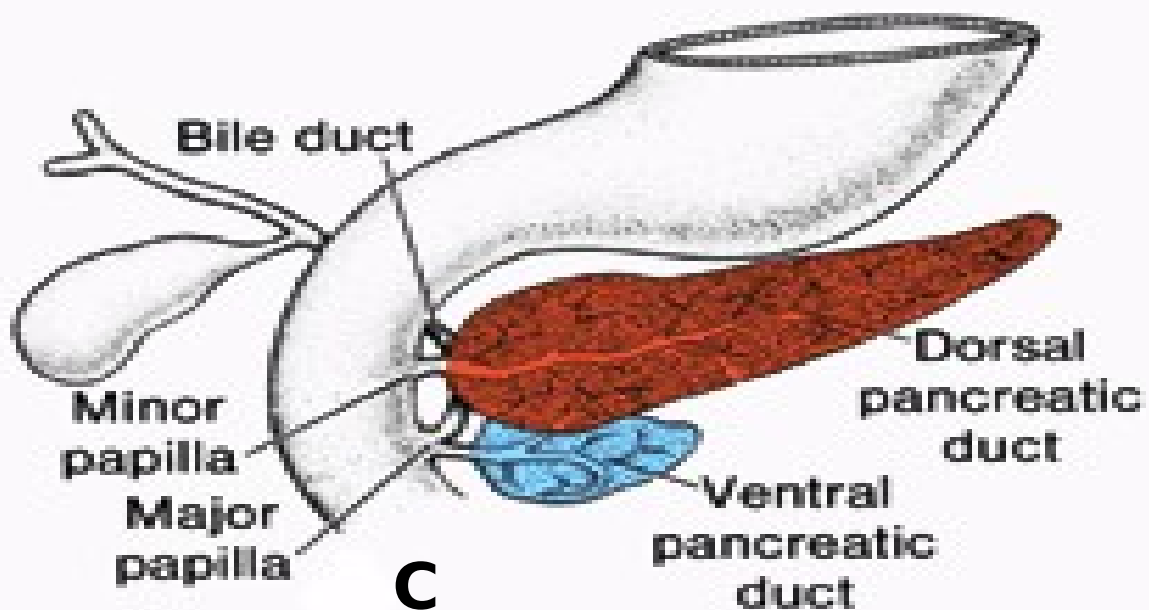
- a. Distally by the **ventral pancreatic duct**.
- b. Proximally by the **dorsal pancreatic duct**.

(This explains why the accessory duct opens cranial to main duct)



## Summary

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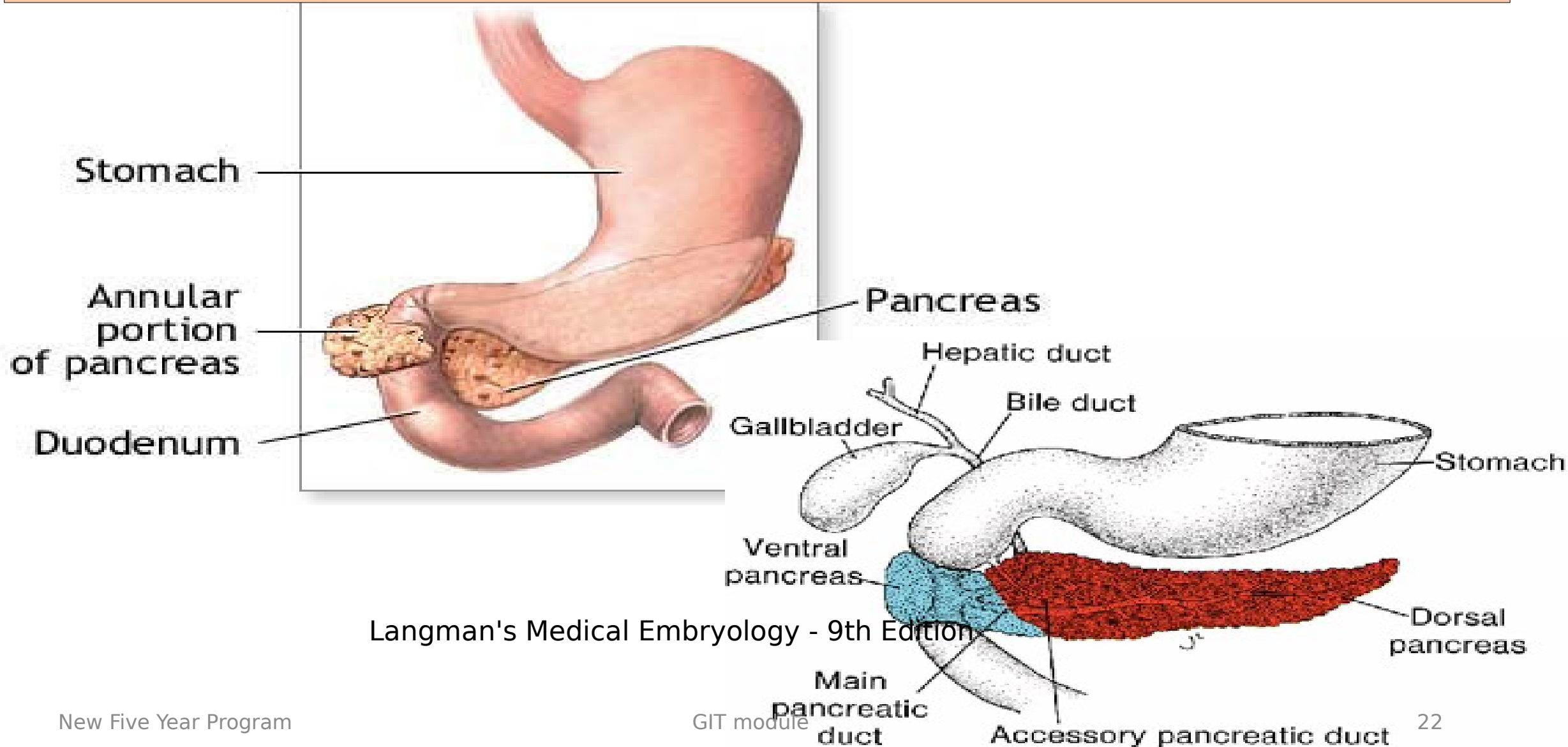


# Anomalies (3 A)



- 1- Accessory pancreatic tissue in stomach, intestine ...etc.**
- 2- Annular pancreas; surrounding the duodenum.**
- 3- Agenesis of any part of pancreas, or its ducts**

## 2- Annular pancreas; surrounding the duodenum (due to failure of rotation)



### 3- Agenesis of any part of pancreas, or its ducts



**Agenesis of neck, body & tail of pancreas**



**The ventral pancreatic bud develops into which of the following parts of the pancreas:**

- A. Neck.**
- B. Body**
- C. Uncinate process.**
- D. Tail.**



**The ventral pancreatic bud develops into which of the following parts of the pancreas:**

**A. Neck.**

**B. Body**

**C. Uncinate process.**

**D. Tail.**

# ما هي العبقرية ؟

• توماس إديسون عرّف  
العبقرية :

1% إلهام وحلم  
99% عرق وجهد





# Hindgut

## *Development of the Hindgut*

- Hindgut gives rise to:
  - last 1/3 of transverse colon
  - descending colon
  - sigmoid colon
  - rectum
  - upper 2/3 of anal canal

**Inf. Mesenteric Artery**

Proctodeum

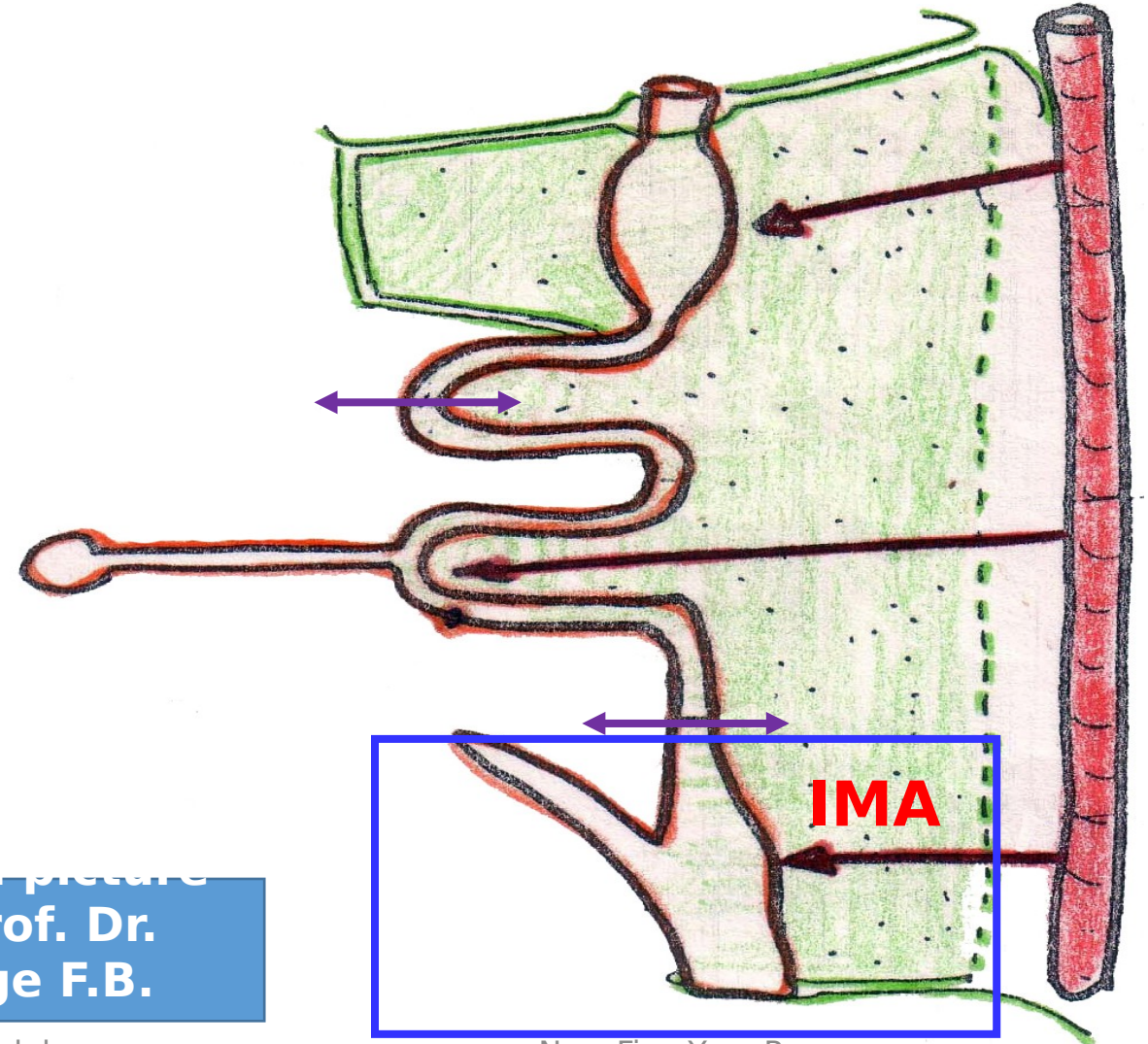
Hindgut



# The primitive hindgut



- The **hindgut** lies below the midgut separated by the **post. intestinal portal**.
- It is connected to the post. abdominal wall by **Dorsal mesentry (= Dorsal mesocolon)** through which passes the **IMA**.

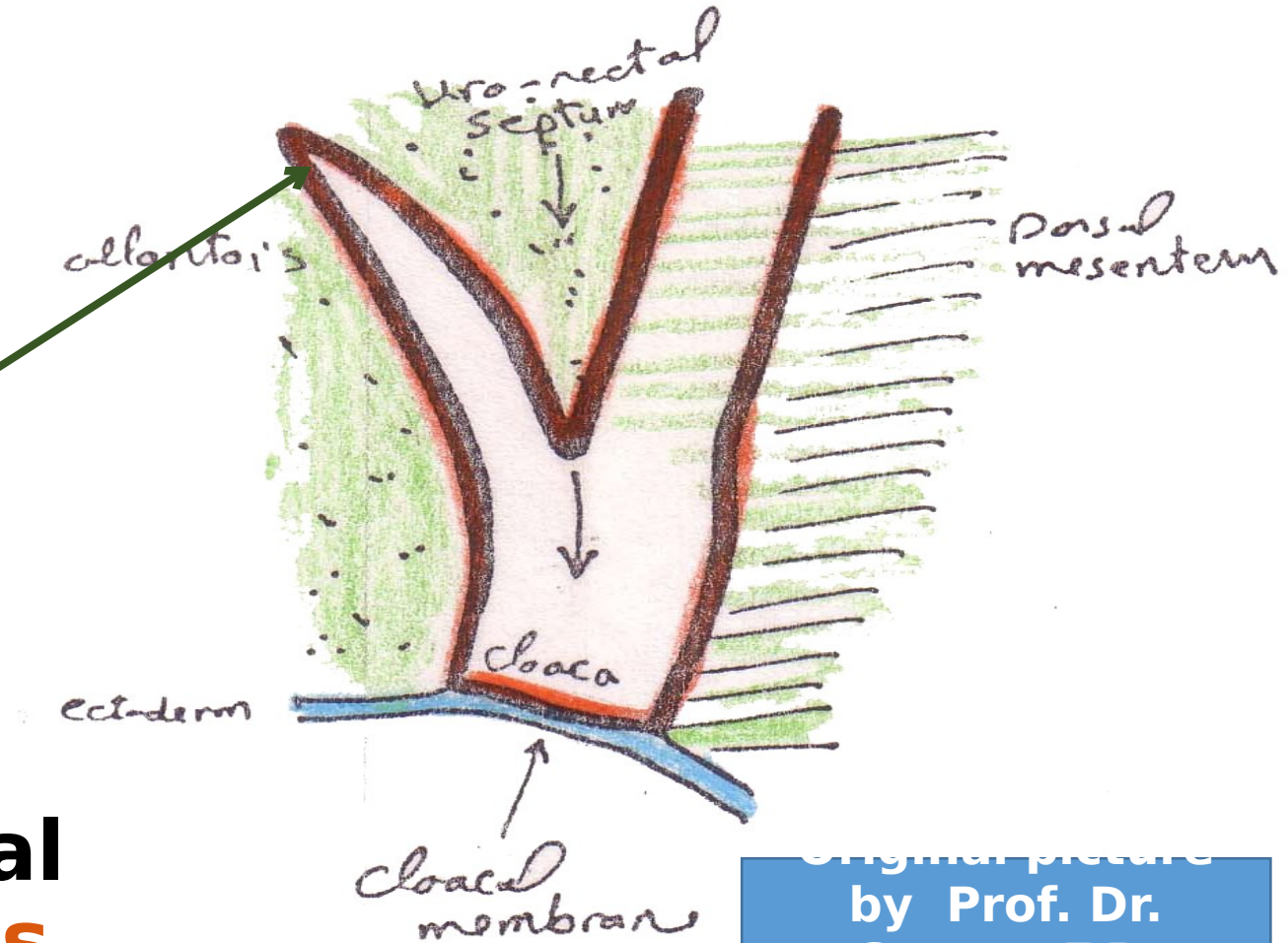


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# The primitive hindgut



- The distal part of the hindgut is dilated & called **Cloaca**:
  - a. It is closed by the **cloacal membrane**.
  - b. It sends a forward projection called **Allantois**, the distal blind end of which (reaching the umbilical cord) is called **Urachus**.



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# What happens ?

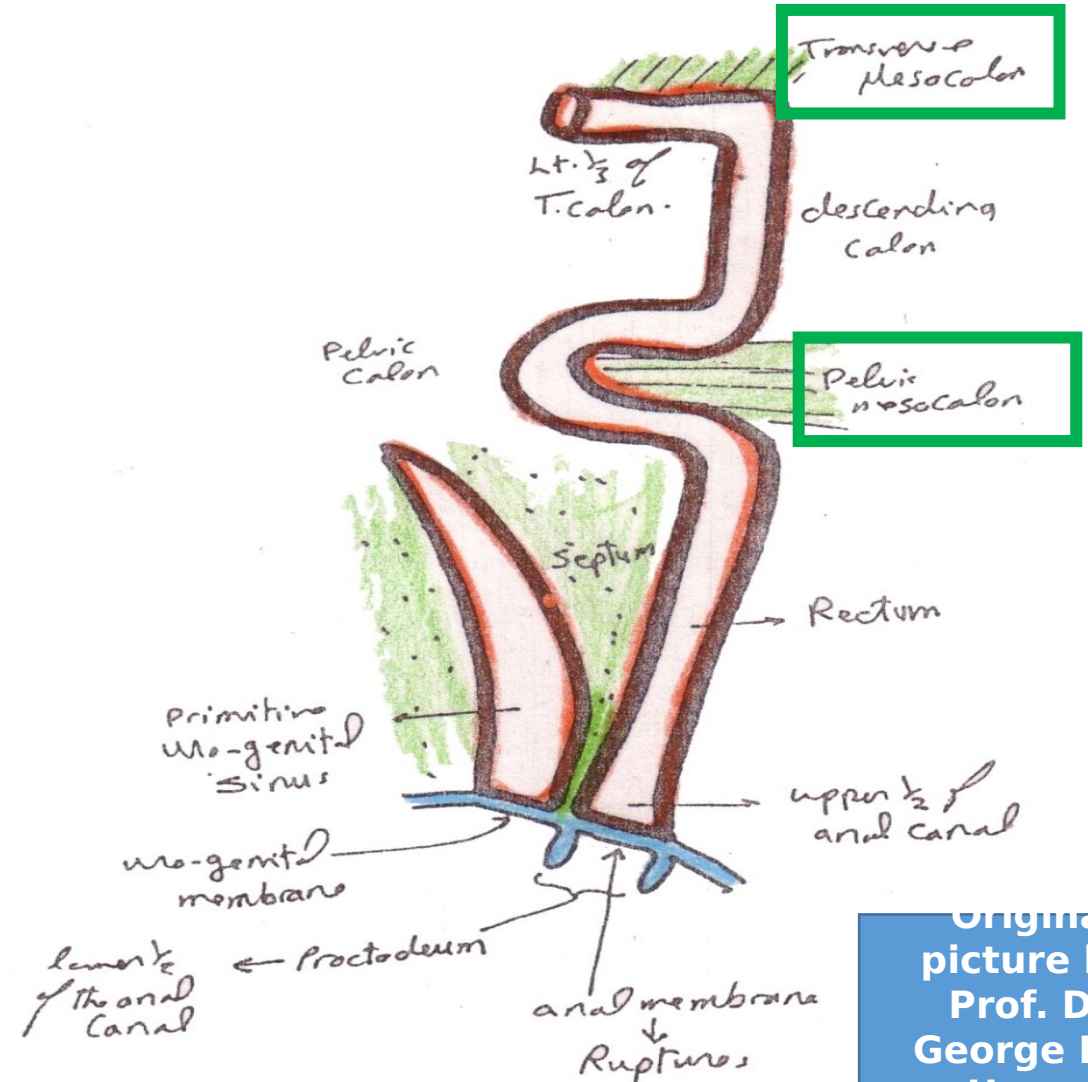


▪ The hindgut gives rise to:

- 1- Lt. 1/3 of transverse colon.
- 2- Lt. colic flexure.
- 3- Descending colon.
- 4- Sigmoid (pelvic) colon.
- 5- Rectum.
- 6- Upper part of anal canal.

▪ All these derivatives are supplied by **IMA**.

▪ The dorsal mesocolon persists **only** in the regions of transverse & sigmoid colons giving rise to their mesocolons.



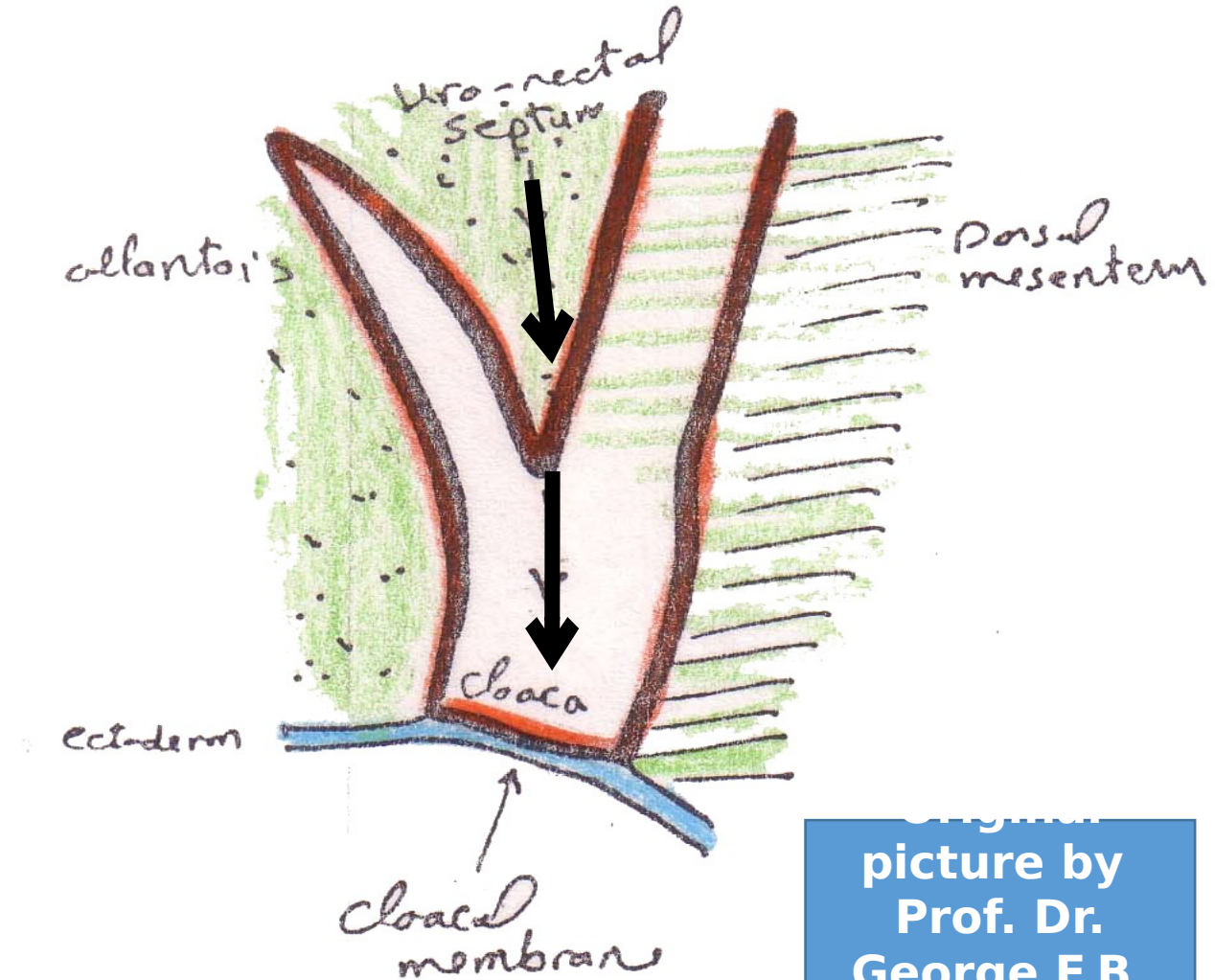
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# What happens to the cloaca ?



- It is divided by a **mesodermal septum (called Uro-rectal septum)** which extends downwards to meet the **cloacal membrane**.
- The cloacal membrane & the cloaca are now divided by the uro-rectal septum into 2 parts each.



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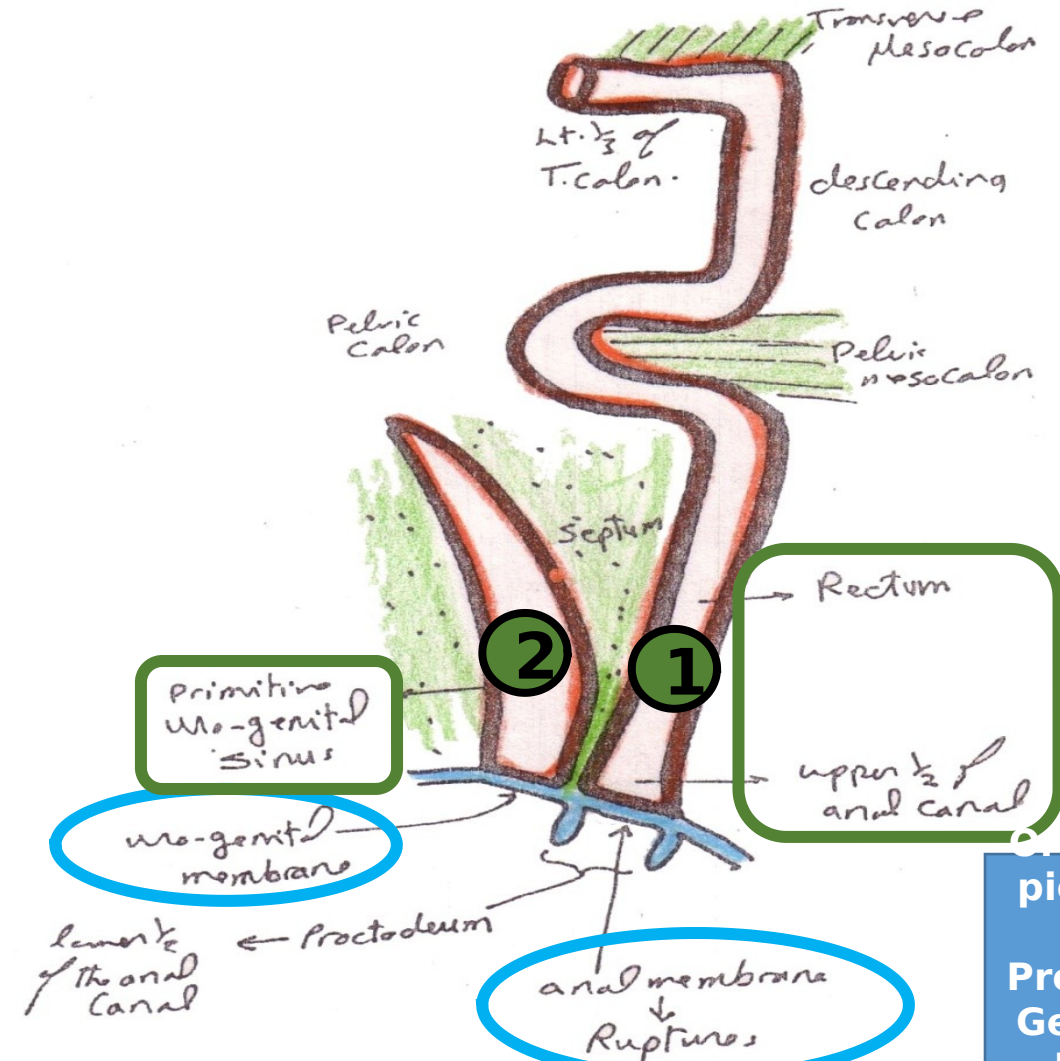


## ▪ 2 Parts of the cloaca:

- 1- **Ano-rectal part** (post. to the uro-rectal septum) → Rectum & upper part of anal canal, which is thus endodermal & pain insensitive.
- 2- **Primitive urogenital sinus = UGS** (ant. to the uro-rectal septum) → Urinary bladder & part of urethra (see urinary system development).

## ▪ 2 Parts of the cloacal membrane:

- 1- **Post. part** closing the anorectal part = **Anal membrane.**
- 2- **Ant. part** closing the primitive UGS = **Urogenital membrane**



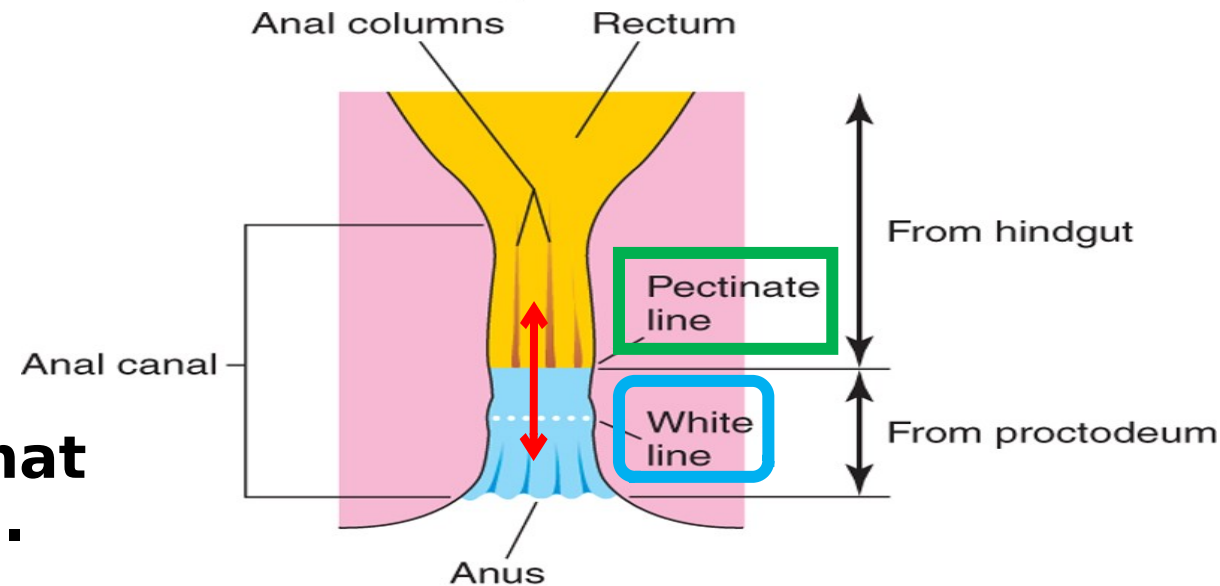
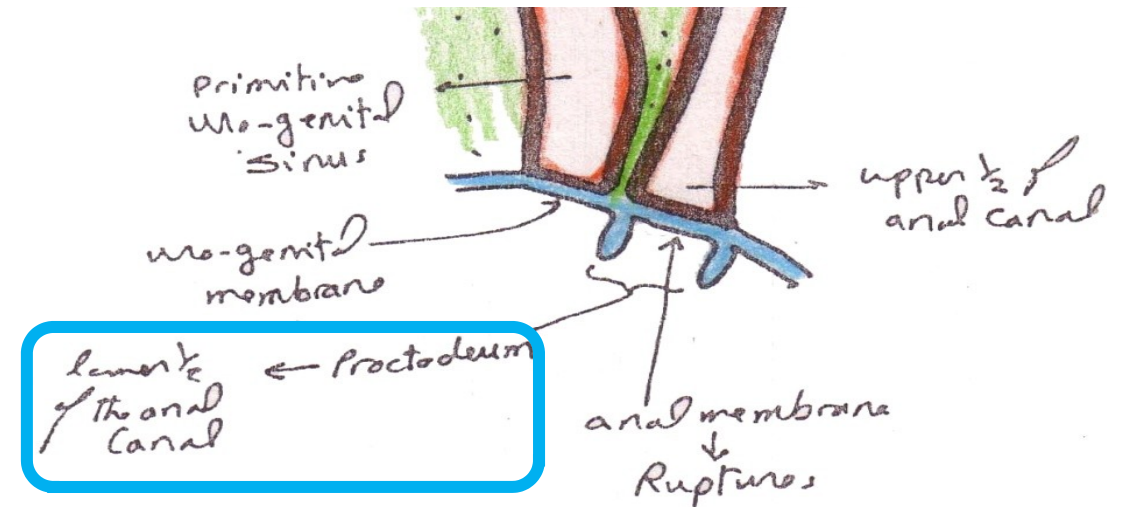
▪ In the region of anal membrane, the overlying ectoderm proliferates to form a cup-shaped **Proctodeum**:

1- It gives rise to the **lower part of the anal canal**, which is thus ectodermal & pain sensitive.

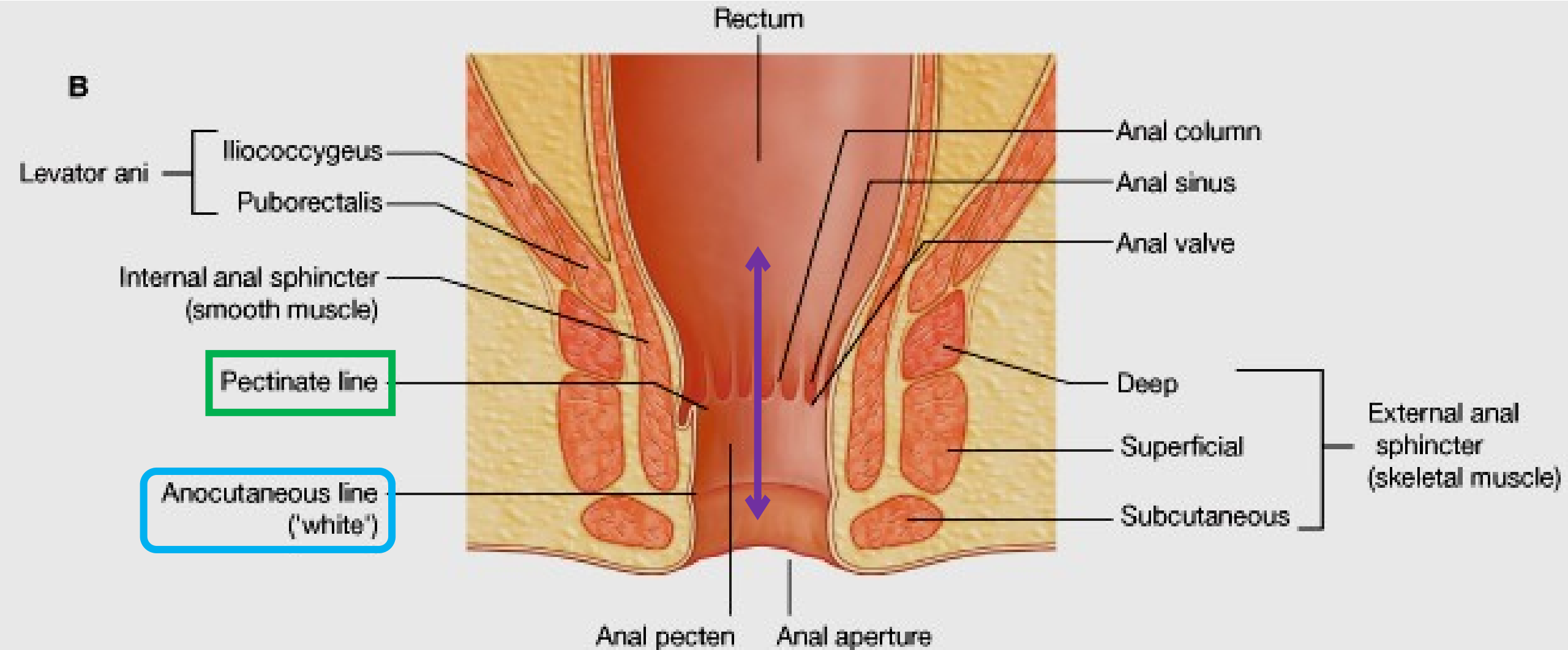
2- The anal membrane separates the 2 parts of the anal canal & later ruptures:

a. Thus the 2 parts become continuous.

b. Remnants of the anal membrane are represented by the **white line** (located below the **pectinate line** that marks the level of the anal valves).



# Let's have a look at the adult stage



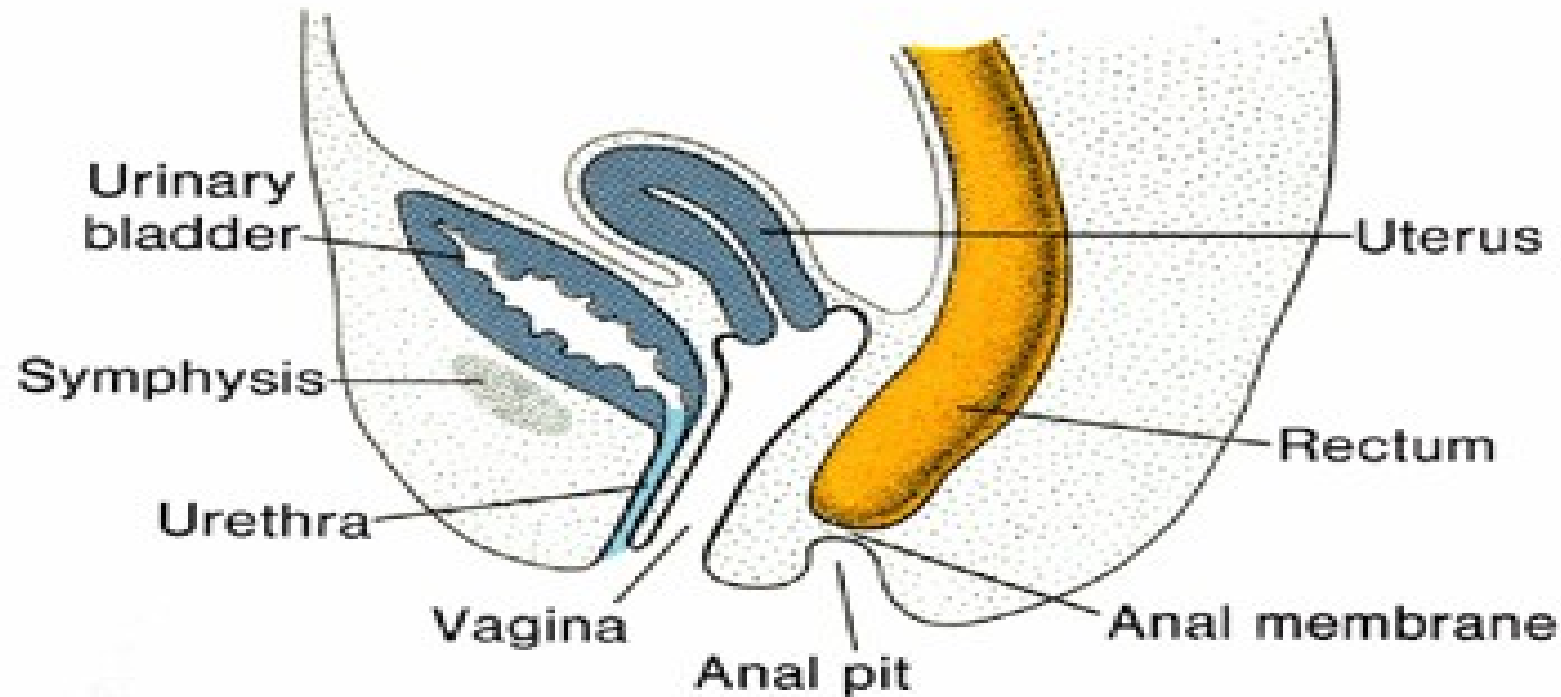
# Anomalies



- 1) Atresia or stenosis of any part.**
- 2) Imperforate anus.**
- 3) Uro-rectal fistulae.**
- 4) Congenital megacolon.**

# Imperforate anus

- Due to
  - a. Failure to communicate with proctodeum, OR
  - b. Failure of the anal membrane to rupture.

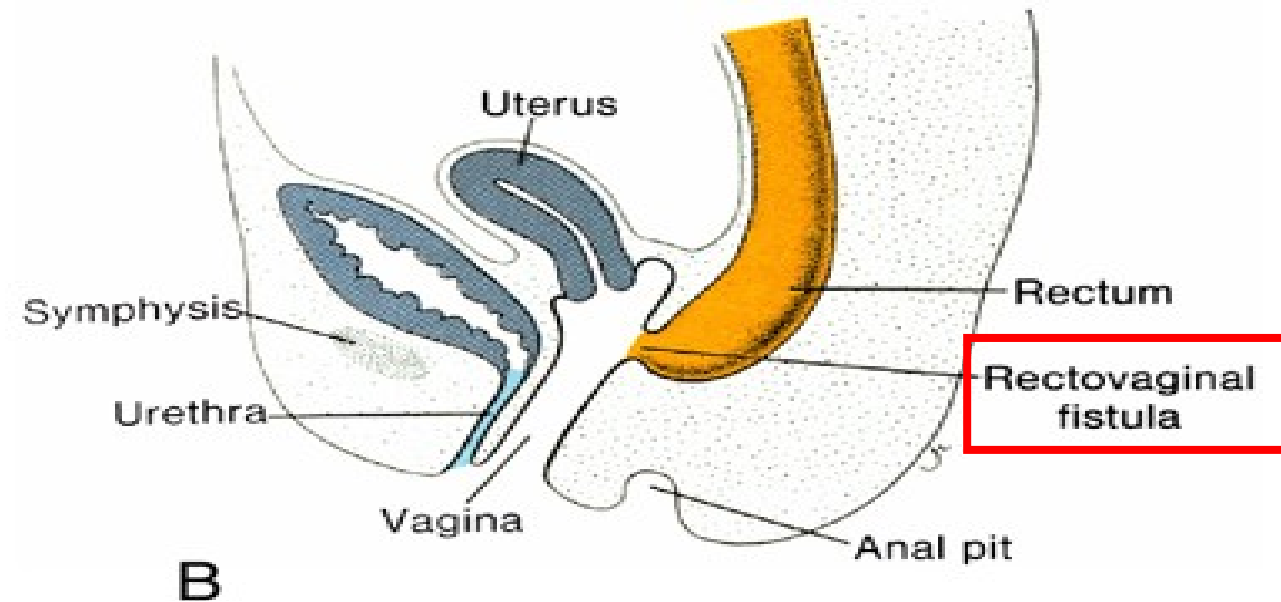
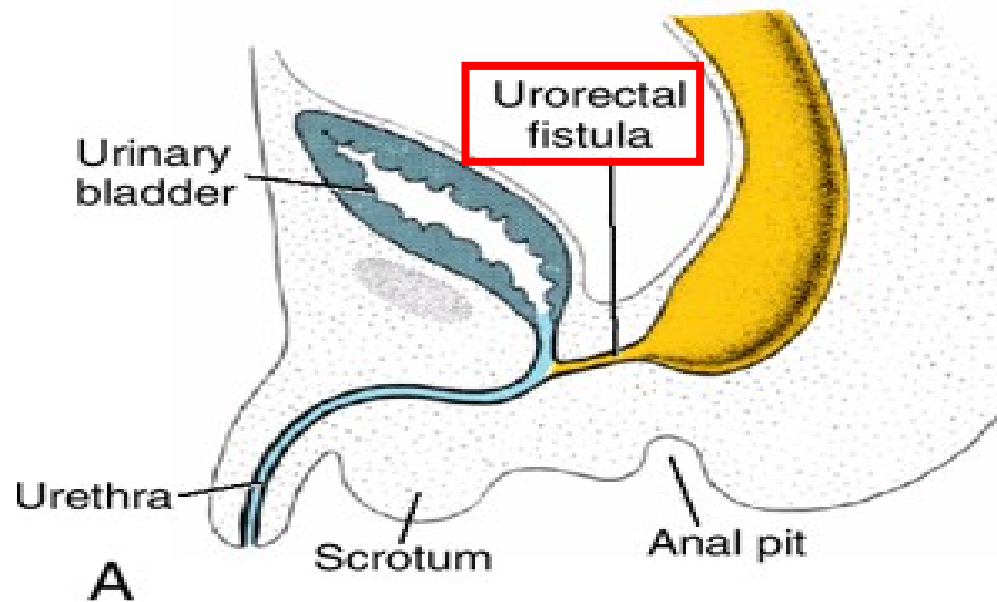


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# Uro-rectal fistulae

- Due to failure of the uro-rectal septum to fuse with the cloacal membrane.

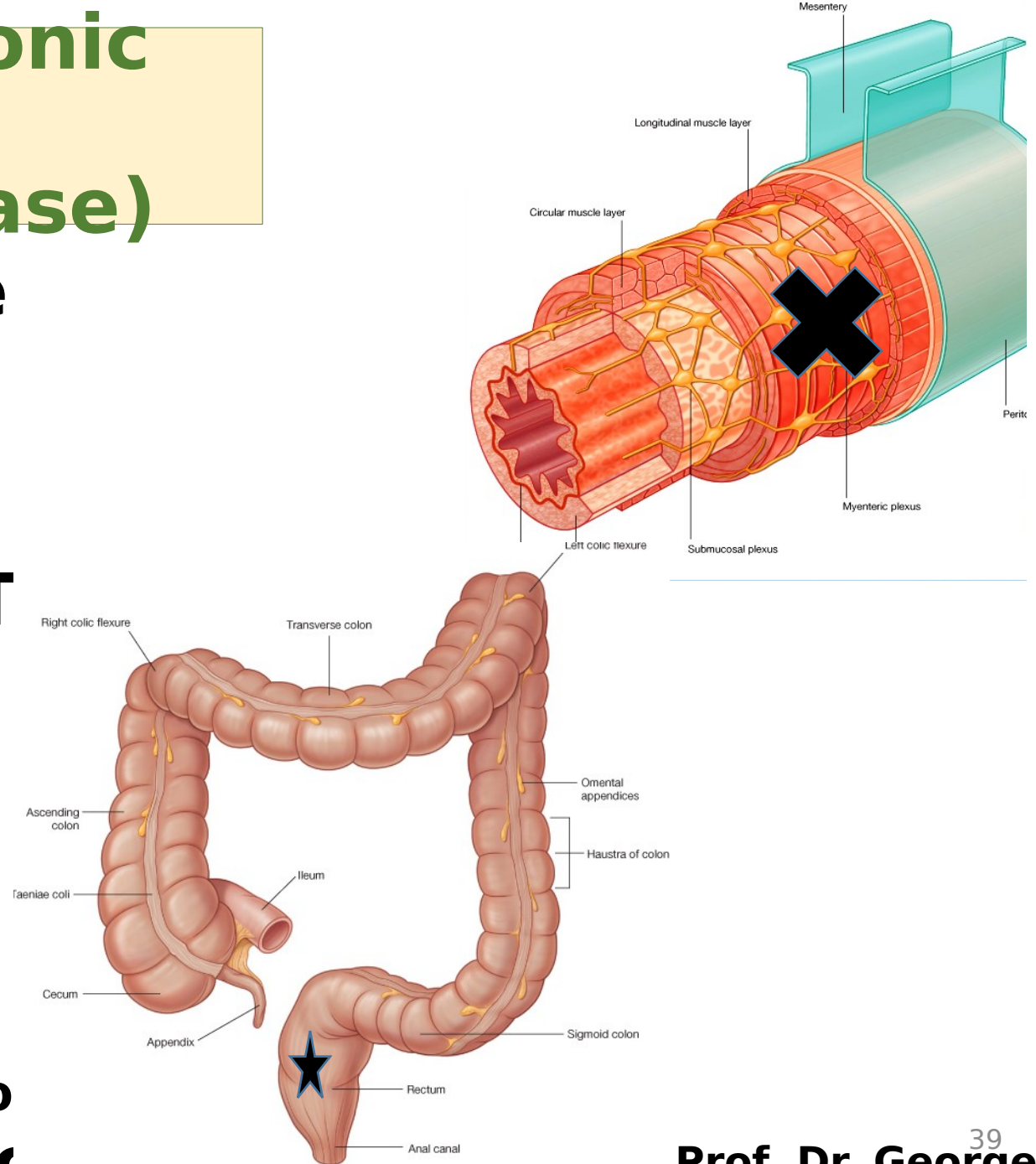


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# Congenital aganglionic megacolon (Hirschsprung disease)

- Is due to an absence of parasympathetic ganglia in the bowel wall due to mutations in the RET gene (These ganglia are derived from neural crest cells).
- Site: In most cases the rectum is involved, and in 80% the defect extends to





**The cloaca does not give rise to which one of the following structures ?**

- A. Urinary bladder.**
- B. Part of urethra.**
- C. Part of anal canal.**
- D. Anal orifice.**
- E. Rectum.**



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# SUGGESTED TEXTBOOKS



*Langman's Medical Embryology, 9<sup>th</sup> edition, Chapter 13 , p. 298- 304, 313- 317.*

# Thank You